Section: Orthopaedics

Original Research Article

EFFICACY OF ROPIVACAINE COMBINED W ITH DEXMEDETOMIDINE FOR POST-OPERATIVE ANALGESIA FOLLOING ULTRASONOGRAPHY GUIDED AXILLARY BRACHIAL PLEXUS BLOCK FOR UPPER LIMB ORTHOPAEDIC SURGERY : A DOUBLE BLIND, RANDOMIZED CONTROLLED TRIAL

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Abstract

To evaluate and compare the efficacy of Ropivacaine with or without Dexmeditomidine following ultrasonography guided axillary brachial plexus block for upper limb orthopedic surgery. Primary Objective: To determine and compare the duration of analgesia between patients receiving Ropivacaine alone and Ropivacaine combined with Dexmedetomidine for ultrasound guided brachial plexus block undergoing upper limb orthopedic surgeries. Secondary objective: To determine the difference in onset of sensory and motor blocks produced by Ropivacaine alone and Ropivacaine combined with Dexmedetomidine. To determine the change in hemodynamic responses and other adverse effects like nausea, vomiting, respiratory difficulty, drug toxicity etc if any.

INTRODUCTION

Ultrasonography guided peripheral nerve blocks widely used in orthopedic surgeries to maintain adequate Intraoperative analgesia and analgesia in postoperative period without substantial adverse effects with minimal anesthetic medication.[1] Regional anesthesia is advantageous over general anesthesia for better postoperative analgesia and can be administered in patient where general anesthesia is contraindicated. Ropivacaine is commonly used local anesthetic agent for peripheral nerve blocks with minimal side effects. However single bolus of Ropivacaine does not last long, so a continuous infusion is usually necessary for a longer duration of postoperative analgesia. This may lead to increase medical and nursing expenses. Intensive monitoring required for those patient. So there has been increasing interest in prolonging the analgesic effect of local anesthetic agent. Adjuvant like Dexmedetomidine, an alpha 2 adrenergic receptor agonist, is found to exert significant analgesic action for enhancement of the duration of sensory as well as motor block.[2] This study aimed to investigate the analgesic effect of Dexmedetomidine added to Ropivacaine for ultrasonography guided axillary brachial plexus block for upper limb orthopedic surgery. We want also to find out the significant adverse effects of the drug and the procedure like nausea vomiting hemodynamic alteration sedation pneumothorax.

MATERIALS AND METHODS

After getting approval from institutional ethical committee of Tezpur Medical College & Hospital and obtaining informed written consent, 70 patients were selected aged 20-60 years ASA status I and II for the study. The exclusion criteria was ASA III and above with severe cardiac pulmonary renal or hepatic dysfunction, cognitive impairment, psychological and mental disorder, coagulopathy and allergy to opioids and local anesthetics. Patient were grouped into 2 groups of 35 each. Group R are receiving 30ml of 0.5% Ropivacaine with 1ml of normal saline (0.9%). Group RD are receiving 30ml of 0.5% Ropivacaine with 100 microgram Dexmeditomidine. Random allocation cards were made for 70 selected patient using computer generated random number. Allocation concealment was done through SNOSE (sequentially numbered, opaque, sealed and stapled envelopes)method. An operating room technician given charge for allocation card for 70 selected patients using

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computer generated random numbers and divided them into 2 equal groups of 35 each. Another technician have put these card in sequentially numbered opaque envelopes according to the randomized order of the patient and sealed and stapled them (SNOSE method). The envelope were sequentially open just before the injection by an independent nurse who maintaining all aseptic antiseptic measure, prepare the injection as mentioned in the card inside for the particular patient and handed over the syringe containing the inject able to the anesthetist performing the procedure. Input date, time, patient id, result after the procedure etc recorded on a sheet. The envelope was sealed and preserved in secure place for future reference.

In the OT, the patients were cannulated with 18 G peripheral cannulae. Ringer lactate drips were connected. All patients were monitored with ECG leads pulse oximetry probe noninvasive blood pressure cuff.

All patients were counseled and given premedication inj fentanyl 0.5 ug/kg and inj midazolam 0.05 mg / kg intravenously 15 minutes before the procedure. An axillary brachial plexus block was given with the patient lying supine with the arm abducted from the body (90o) and flexed at the elbow joint (90o) . The ultrasound probe was placed over axillary region and the axillary sheath was identified. It was approached using a 50 mm insulated needle with a catheter to inject the LA solution. After repeated negative aspirations, 10ml of local anaesthetic solution, which contains either Ropivacaine alone or Ropivacaine ith dexmedetomidine, was injected at each nerve (radial, ulnar, median, musculocutaneous). Totally 30ml is given with either 1ml of normal saline or 1ml of dexmedetomidine, which is 100microgram.

Visual analogue scale (VAS) duration of analgesia, onset, duration of sensory and motor block, respiratory rate, other hemodynamic parameter were observed and represented in tables and charts.

Descriptive analysis were carried out categorically and analyzed using IBM SPSS 20.0 Software.

For normally distributed quantitative parameters, were tested using an independent sample t-test. For non normally distributed quantitative parameters ere compared between study groups using Mann Whitney u test. The chin square/ Fisher's exact test were used to see the statistical significance. P value <0.05 was considered statistically significant.

RESULTS

Table 1: Demographic data

	Ropivacaine	Ropivacaine with dex	P value
Age group	44.06+- 8.90	40 +_ 11.59	0.1051
Height	164.31+_ 7.41	164.91 +_ 7.66	0.7659(p>0.05)
Weight	70.57 +_ 5.29	69.29 +_ 5.71	0.3319 (p>0.05)
ASA I	31(88.57%)	29 (82.86%)	0.7913(p>0.05)
ASA II	4(11 .43%)	6 (17.16%)	
Duration of surgery	115.11+_15.62	113.54+_16.02	0.6790(p>0.05)

Table 2: Vas Score

Vas	Ropivacaine	Ropivacaine with Dex	P - value
At 4 hour	2.11+_ 0.32	0.06 +_0.24	0.0001(P<0.05)
At 7 hour	2.83+-0.38	0.60+-0.65	0.0001(P<0.05)
At 10 hour	3.81+-0.40	2.49+-0.51	0.0001(P<0.05)
At 13 hour	-	3.53+-0.57	-

Table 3: Analgesia

Duration of analgesia	636.29+-35.22	815.71+-49.01	0.0001(P<0.05)
Onset of sensory block	13.80+-1.43	11.40+-1.35	0.0001(P<0.05)
Onset of motor block	18.14+-1.75	16.86+-1.44	0.0013(P<0.05)
Duration of sensory block	567.00+-5.71	744.86+-46.57	<0.0001(P<0.05)
Duration of motor block	489.89+-40.56	618.71+-41.52	<0.0001(P<0.05)

Table 4: Heart rate

Heart rate	Ropivacaine	Ropivacaine with dex	P-value
Preoperative	81.50+-17.14	85.47+-16.46	0.0781(P>0.05)
At 5min	80.97+-17.10	77.94+-15.53	0.1682(P>0.05)
At 10 min	80.97+-16.46	78.24+-15.53	0.1970(P>0.05)
At 15 min	80.62+-15.77	78.18+-15.38	0.1141(P>0.05)
At 20min	81.76+-16.58	79.00+-15.46	0.1751(P>0.05)
At 25 min	81.85+-16.46	79.79+-15.80	0.3249(P>0.05)
At 30 min	81.71+-17.06	79.76+-16.04	0.3811(P>0.05)
At 45 min	82.12+-16.87	80.29+-16.15	0.4394(P>0.05)
At 1hr	81.91+-16.58	79.71+-15.95	0.3065(P>0.05)
At 2 hr	82.29+-16.71	80.65+-16.11	0.4365(P>0.05)
At 4th hr	82.71+-16.58	81.56+-16.12	0.6116(P>0.05)
At 8th hr	80.62+-16.58	81.56+-16.12	0.5956 (P>0.05)

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At 12 hr	81.00+-16.63	78.88+-15.54	0.3151(P>0.05

Table 5: Systolic blood pressure

SBP	Ropivacaine	Ropivacaine with dex	P-value
Preoperative	126.12+-24.07	124.59+-24.51	0.5845(P>0.05)
At 5min	128.88+-23.41	123.12+-23.25	0.2707(P>0.05)
At 10min	124.24+-23.43	123.94+-23.78	0.9305(P>0.05)
At 15 min	124.29+-23.32	123.47+-23.67	0.7207(P>0.05)
At 20min	125.82+-23.65	124.65+-24.27	0.6812(P>0.05)
At 25 min	125.65+-23.22	123.59+-23.36	0.3932(P>0.05)
At 45min	125.35+-22.43	122.59+-22.65	0.1803(P>0.05)
At 1st hr	125.47+-22.59	123.88+-22.65	0.1803(P>0.05)
At 2nd hr	126.29+-22.62	124.53+-23.30	0.4464(P>0.05)
At 4th hr	125.41+-22.09	123.18+-22.28	0.2087(P>0.05)
At 8th hr	125.41+-22.47	133.82+-22.79	0.4264(P>0.05)
At 12 hr	125.59+-22.53	124.18+-22.79	0.4617(P>0.05)

Table 6: Diastolic blood pressure

DPB	Ropivacaine	Ropivacaine with dex	P-value
Preoperative	75.71+-15.29	73.47+-13.04	0.1989(P>0.05)
At 5min	74.88+-14.71	72.24+-12.71	0.0762(P>0.05)
At 10 min	75.12+-14.62	72.18+-12.93	0.0585(P>0.05)
At 15min	75.35+-14.55	72.59+-12.82	0.0684(P>0.05)
At 20 min	75.12+-14.65	72.47+-12.65	0.0813(P>0.05)
At 25 min	75.18+-14.70	72.65+-12.65	0.0890(P>0.05)
At 45 min	74.76+-14.07	72.47+-12.54	0.0675(P>0.05)
At 1st hr	74.24+-13.84	71.94+-12.58	0.0559(P>0.05)
At 2nd hr	73.00+-13.99	71.06+-12.44	0.0981(P>0.05)
At 4th hr	72.94+-14.13	70.53+-12.40	0.0584(P>0.05)
At 8th hr	74.06+-13.94	72.00+-12.49	0.0605(P>0.05)
At 12th hr	74.88+-13.96	72.76+-12.70	0.0655(P>0.05)

Table7: Mean arterial pressure

MAP	Ropivacaine	Ropivacaine with dex	P-value
Preoperative	92.76+-17.80	90.47+-16.59	0.2698(P>0.05)
At 5min	92.00+-17.30	89.18+-16.06	0.1151(P>0.05)
At 10 min	91.44+-17.27	88.03+-16.57	0.0758(P>0.05)
At 15min	91.76+-17.08	88.97+-16.16	0.1144(P>0.05)
At 20 min	92.15+-17.12	89.88+-16.20	0.1859(P>0.05)
At 25 min	92.21+17.20	89.15+-16.01	0.0735(P>0.05)
At 45 min	91.74+-16.57	89.24+-15.74	0.0606(P>0.05)
At 1st hr	91.50+-16.47	89.18+-15.72	0.0776(P>0.05)
At 2nd hr	90.97+-16.67	88.59+-15.82	0.1240(P>0.05)
At 4th hr	90.56+-16.45	87.88+-15.47	0.0607(P>0.05)
At 8th hr	91.35+-16.47	88.91+-15.70	0.0709(P>0.05)
At 12th hr	92.06+-16.61	89.44+-15.83	0.0528(P>0.05)

Table 8: Respiratory rate

Respiratory rate	Ropivacaine	Ropivacaine with dex	P-value
Preoperative	14.32+-2.58	13.94+-2.58	0.088 (P>0.05)
At 5min	13.94+-2.59	14.00+-2.59	0.9133(P>0.05)
At 10 min	13.94+-2.56	13.91+-2.62	0.8210(P>0.05)
At 15min	13.94+-2.54	13.94+-2.63	0.9948(P>0.05)
At 20 min	14.21+-2.62	14.12+-2.60	0.6619(P>0.05)
At 25 min	14.26+-2.61	14.03+-2.57	0.2529(P>0.05)
At 45 min	14.41+-2.65	14.35+-2.67	0.6942(P>0.05)
At 1st hr	14.29+-2.60	14.21+-2.58	0.5608(P>0.05)
At 2nd hr	14.09+-2.53	13.97+-2.60	0.4841(P>0.05)
At 4th hr	14.38+-2.60	14.50+-2.73	0.6995(P>0.05)
At 8th hr	14.32+-2.62	14.50+-2.62	0.5012(P>0.05)
At 12th hr	14.68+-3.11	14.47+-2.76	0.5834(P>0.05)

Table 9: Oxygen saturation (SPO2)

SPO2	Ropivacaine	Ropivacaine with dex	P-value
Preoperative	99.24+-16.79	99.21+-16.78	0.7599(P>0.05)
At 5min	99.00+-16.75	99.03+-16.75	0.7362(P>0.05)
At 10 min	98.94+-16.74	99.00+-16.75	0.6227(P>0.05)
At 15min	98.71+-16.70	98.85+-16.73	0.4554(P>0.05)
At 20 min	98.97+-16.74	99.09+-16.76	0.4832(P>0.05)
At 25 min	98.88+-16.73	99.15+-16.77	0.1199(P>0.05)
At 45 min	99.06+-16.76	99.06+-16.75	0.8599(P>0.05)

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At 1st hr	98.94+-16.74	98.82+-16.72	0.4942(P>0.05)
At 2nd hr	98.76+-16.71	98.74+-16.71	0.8357(P>0.05)
At 4th hr	98.79+-16.71	98.91+-16.73	0.5929(P>0.05)
At 8th hr	99.03+-16.75	98.91+-16.74	0.4170(P>0.05)
At 12th hr	99.06+-16.75	99.12+-16.76	0.4839(P>0.05)

DISCUSSION

The use of Axillary Brachial Plexus block as an Anesthetic technique for upper limb orthopedic procedures has become increasingly popular in recent years. Moreover its popularity over other techniques is due to its benefits, like a decreased stress response to surgery, prolong post operative analgesia, decrease respiratory and cardiac depression. This technique reduces the risk associated with general anesthesia, including accident related to airway management, aspiration and poly pharmacy.[6]

Ropivacaine is a long acting local anesthetic that is structurally related to bupivacaine. In our study we took total number of 70 patients and divided them randomly into two groups. Group R (Ropivacaine alone) and Group RD (Ropivacaine with dexmedetomidine). In our study we found that the mean duration of analgesia as 815.71+-49.01 min for Ropivacaine with dexmedetomidine group (RD) and 636.29+-35.22 min for Ropivacaine group(R). We found highly significant difference ($p<0.0001$) between the study groups.In similar study by BANSAL P,KHATRI M.L AND GARG K.L (2016) found that the duration of analgesia was significantly longer in Ropivacaine with dexmedetomidine group than Ropivacaine alone.

In our study we found that the mean time of onset of sensory block was 11.40+-1.35 min for Ropivacaine with dexmedetomidine(RD) AND 13.80 +-1.43 for Ropivacaine group(R).In similar study BANSAL P,KHATRI M.L AND GARG K.L (2016) compared the onset and duration of motor block and found significant in group RD and consistent with our study.

In our study,we found that the mean time for onset of motor block was 16.86+- 1.44 min for the Ropivacaine with dexmedetomidine group(RD) and 18.14 +- 1.75 min for Ropivacaine group (R).We found a highly significant difference ($p=0.0013$) between the study groups.In 2017 CHINNAPPA J,Shivanna,Pujari V.S and Anandaswamy TC compared the onset and duration of sensory and motor block in similar study which was statistically significant and consistent with our study.

In our study we found the mean duration of sensory block was 774.86+-46.57 min for Ropivacaine with dexmedetomidine group(RD) and 567.00 +- 35.71 min for Ropivacaine group(R).We found a highly significant difference ($p<0.0001$) between the study groups.In 2019,S SHARMA ET AL. compared the duration of sensory and motor block in similar study found statistically significant difference in both the groups which was consistent with our study.

In our study we found the mean duration of motor block was 618.71+-41.52 min for Ropivacaine with dexmedetomidine group(RD) and 489.89+-40.56 min for Ropivacaine group(R) .We found highly significant difference ($p<0.0001$) between the study groups.In similar study by BANSAL P,KHATRI M.L AND GARG K.L compared the onset and duration of sensory, motor block and duration of analgesia.They found significant difference between the groups which is consistent with our study.

As far as hemodynamic parameters(pulse rate,systolic blood pressure, diastolic pressure, MAP, Oxygen saturation, respiratory rate) were concerned in our study there was no significantly difference statistically between the groups. BANSAL P, KHATRI M.L AND GARG K.L(2016), CHINNAPPA J, Shivanna S, Pujari V.S and Anandaswamy TC(2017) AND SHARMA S, Shrestha A ,Koirala M(2019) also did not notice any significant hemodynamic differences between the two groups.

In our study, no group experienced any adverse outcome. BANSAL P, KHATRI M.L AND GARG K.L et al.(2016),CHINNAPPA J,Shivanna S, Pujari V.S and Anandasamy TC(2017) and SHARMA S,Shrestha A, koirala M (2019) also did not notice any significant adverse effects.

CONCLUSION

0.5% Ropivacaine with 100 micrograms of Dexmeditomidine showed a longer duration of analgesia, a shorter onset of action and longer duration for both sensory and motor blockade compared to 0.5% Ropivacaine alone.

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